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SCIENCE

FRIDAY, OCTOBER 14, 1887.

IT IS UNDERSTOOD that General Greely has decided to discontinue the collection of marine data from masters of vessels, relying upon the Hydrographic Office to furnish whatever information may be needed in the work of his office. This change went into effect Oct. 1; and at the close of this year the Signal Service will discontinue also all work in connection with the international simultaneous meteorological observations, excepting so far as may be necessary to complete the publication of the results up to Jan. 1, 1888, thus bringing to a close a period of ten years' continuous observation. It is greatly to be hoped that the Hydrographic Office will make every effort to continue this very important work, and that Congress will authorize the further publication of the results in some such form as has been hitherto done, and so well done, by the Signal Service. The importance of this comparatively modern and only really scientific method of studying marine meteorology can hardly be overestimated. Indeed, if the vessels of all nations traversing the North Atlantic could be induced by the Hydrographic Office to take not merely one observation, but three simultaneous observations daily, corresponding in time to those taken at all our Signal Service stations, it could not fail to result in such an increase in the safety and certainty of navigation, in this the most important ocean on the globe to civilized man, as to make the expense and trouble involved wholly insignificant. The marine data collected by the Hydrographic Office are immediately utilized, so far as possible, in preparing the Mascart cablegram, sent to Europe every night by the Signal Service for the benefit of westward-bound vessels, and in compiling the 'Pilot Chart of the North Atlantic Ocean,' issued the first day of each month by the Hydrographic Office as a guide to navigation. In addition to this, all such data have, of course, a further, though less immediate, value as constituting the foundation upon which future progress in the study of ocean meteorology must be largely based. Here, as in every science, old observations and methods of work guide the way to further advances; so that, with improved instruments and methods, still greater practical benefits can be looked for. The results thus obtained can nowhere be of greater importance to mankind than in the North Atlantic Ocean, the great highway between the Old World and the New.

THE ATTENTION OF SANITARIANS throughout the country is centred on New York City and Tampa, Fla. At the former there arrived, Sept. 22, the steamship 'Alesia' from Naples, Italy, with four cases of cholera on board. During the voyage eight deaths had occurred from the same disease. The passengers were not permitted to come to the city, but were at once taken to the quarantine islands in the bay of New York. Since the debarkation other cases have occurred among the passengers. The lateness of the season will undoubtedly prevent any extension of the disease to the city this year. The presence of this dreaded disease in the port of New York, and the experience of past years in which the disease became epidemic in this country, should be a timely warning to all sanitary authorities. If cholera is to prevail in the United States during the coming year, it can hardly be expected to appear before spring, before which time at least six months will be available for purposes of a thorough cleansing and purifying of filthy spots in both city and country; and that community which neglects to take the necessary preparatory measures to cope with the disease must expect to reap the consequences. In connection with this subject it will not be

amiss to recall public attention to the recommendations which were adopted by the sanitary conference which met at Washington in 1884 in anticipation of the arrival of cholera during the following summer, from which we quote, under 'Health Matters,' in another column. As cholera at New York is attracting the attention of sanitarians, equally so is the possible existence of yellow-fever at Tampa, Fla. A telegram from the deputy-collector of Tampa to the Marine Hospital Bureau announces that there have been twenty-six cases of yellow-fever in that place; and the additional information is given that the doctors disagree as to whether the disease is dengue or yellow-fever. That doctors disagree is not a strange occurrence, and that this disagreement is in reference to the existence of yellow-fever is also no new thing. When undoubted yellow-fever appears in the South, its presence is always denied, and strenuous efforts are made by the local physicians to conceal it; so that to the recognized sanitary authorities must we look for a true statement of the nature of the disease which now prevails at Tampa. Thus far, nothing authoritative has been made public. Dengue prevailed in the West Indies in 1827, and in the following year made its appearance in the South. In the city of Charleston alone there were ten thousand cases, seven-tenths of the population being attacked. It appeared again in Charleston in 1850, and along the southern coast in 1880. It is commonly known as 'breakbone-fever,' from the fact that one stage of the disease is characterized by severe pains throughout the body. It commences with a feeling of chilliness, followed by fever, during which these pains are felt. Sometimes the joints in the hands and feet become swollen, as in rheumatism. Usually there is an eruption resembling measles. The affection lasts eight days, but a considerable time elapses before the strength of the patient is fully recovered. Some authorities regard the disease as contagious, while others deny it. A micrococcus has been described as being the germ of the disease, but this lacks confirmation. Fortunately dengue is not often fatal. In this respect it exhibits a marked contrast to yellow-fever, in which the mortality varies between ten and seventy-five per cent. La Roche states the average mortality to be 1 in 2.32.

NOTHING IS ATTRACTING more attention in agricultural circles just now than the great sorghum-sugar industry. The late results obtained at the experimental sorghum station at Fort Scott, Kan., are most encouraging, and have induced sanguine views of the future of the industry, which can only be compared with the dreams of the average land-speculator. As these views are somewhat amusing, we quote below liberally from one of our correspondents. "This is a great boon for Kansas and Missouri. There are enough acres of farm-land that will produce sorghum in Missouri and Kansas to make millionnaires of every man owning any quantity of land. It is said that the soil will produce from ten to fifteen tons per acre. One man can farm 50 acres of sorghum very comfortably. Fifty acres, yielding 10 tons per acre, is 500 tons of cane. From this the farmer gets \$250 worth of seed. The last run made at Fort Scott yielded 115 pounds of sugar to each ton of cane, which is 1,150 pounds per acre, or, for the 50 acres, 57,500 pounds. This, at the lowest figure possible, 5 cents per pound, is the snug sum of \$2,875. Besides this, there is a yield of 15 gallons of sirup to each ton of cane, making 150 gallons per acre, or 7,500 gallons for the 50 acres. This should sell for 20 cents per gallon, which is \$1,500 more, making the sum total of \$4,625 received from the 50 acres. After deducting the sum of \$1 per ton, the cost of milling, which is \$10 per acre, or \$500 for

the 50 acres, there is a net profit of \$4,125 from the acreage planted. This is clear net profit on the cane, and does not include any charge of profit to the people owning the mill or plant. Kansas has offered a premium of 2 cents a pound for all the sugar produced in that State, and there are 150,000 acres of sorghum grown there, and nearly a million dollars' worth of machinery has been built for experiments in testing the best manner of extracting the juices. Sorghum-sugar can be raised anywhere from the Gulf to Minnesota at less than 1 cent per pound; in fact, one of the sugar engineers of Cuba, after examining the results at Fort Scott, stated that he could put up a plant which would produce sorghum-sugar at 59 cents per hundred pounds. There is no reason why a bounty of \$500,000 a year should not be given to sugar, and as much more to flax, by the government. In thus co-operating with State experimental stations, an unexampled prosperity should result from these endeavors."

THE NICARAGUA CANAL.

ON April 24, 1887, the contract between the Nicaragua Canal Association and the Republic of Nicaragua was signed, and the work on this important route from the Atlantic to the Pacific will therefore soon be taken up.

The principal surveys of the route are those made by O. W. Childs, in 1850-54, on behalf of the American Atlantic and Pacific Ship Canal Company, and those of the United States Surveying Expeditions, 1872-73 and 1885, the former under Commander Hatfield and later under Commander Lull, the latter under A. G. Menocal, who was chief civil engineer of the expedition of 1872-73. Our map is compiled from the maps and profiles published in the reports of these expeditions, and shows the locations of the canal in 1872 and 1885.

Lake Nicaragua, which occupies the central part of the isthmus, will form the summit-level of the canal. Its outlet is the river San Juan, which flows to the Caribbean Sea. Near the lake the river is broad and flows through an open country. It has an average depth of nineteen feet. Twenty-eight miles below Fort San Carlos the river enters a hilly country and forms numerous rapids which obstruct navigation. The last of these are the Machuca Rapids, below which the river has a depth varying from 20 to 60 feet, with but little current: this section is called 'Agua Muerte,' or dead water. At the foot of the Agua Muerte the San Carlos is received into the river, and is the first considerable tributary. This river comes from a long distance up in the Costa Rica hills, and carries a considerable amount of detritus which consists chiefly of volcanic sands. Below the confluence the San Juan changes its character altogether, and is filled with shoals and sand-bars. An additional amount of detritus of a similar character is carried into the San Juan by the Serapiqui. While the upper course of the San Juan, which is almost exclusively fed by Lake Nicaragua, is not subject to freshets, its lower part, below the confluence of the San Carlos, partakes of the character of that river, which is a torrent during the rainy season, and has little water during the dry season. Therefore the lower part of the river cannot be made use of for navigation, and an independent canal to the Caribbean Sea must be built. In the location of 1872-73 the canal followed the river, and then crossed its delta to the lagoon of Greytown.

Thirteen miles below the confluence of the Serapiqui the delta of the San Juan begins. The principal arm of the river is the Rio Colorado, which flows to the eastward and empties into the sea. The other arm is the Lower San Juan, which passes more to the northward, and is divided into several mouths, which discharge their waters into the sea and into the lagoon of Greytown. The delta consists of the light volcanic sand carried into the San Juan by its southern tributaries. This silt has almost totally destroyed the harbor of Greytown by closing up the old entrance and filling a great part of the harbor. The silt is being carried into it by the Lower San Juan and the current. Therefore it is proposed to cut off the Lower San Juan, to send all the water through the Colorado into the sea, and to build a jetty for keeping the silt out of the harbor, which will be improved by dredging.

When the project of a canal through Nicaragua was first discussed, several routes from the lake to the Pacific Ocean were pro-

posed. The one advocated by Napoleon ran from the lake through the Rio Tipitapa to Lake Managua, and continued to the port of Realejo. This route, as well as those to Salinas Bay and San Juan del Sur, was found impracticable, and Brito at the mouth of the Rio Grande was chosen as terminus. The upper Rio Grande offers several difficulties on account of the freshets of the river and the narrowness of its valley. This induced Commander Lull to select the Rio del Medio route, though it requires deeper cuttings, as it avoids the upper part of the Rio Grande, while Menocal favors the Rio Lajas route.

The route proposed by Mr. Menocal extends from the harbor of San Juan del Norte, or Greytown, on the Caribbean Sea, to the port of Brito, on the Pacific, a total distance of 169.8 miles, of which 40.3 miles are canal in excavation, and 129.5 miles open navigation through Lake Nicaragua, the river San Juan, and the basin of the river San Francisco, a tributary of the San Juan. Lake Nicaragua, some 90 miles long by about 40 miles wide, the surface of which is 110 feet above sea-level, has been taken as the summit-level of the canal. Leaving the harbor of Brito, the canal follows the valley of the Rio Grande with a gradual inclination of about 12 feet to the mile, ascending by means of four locks, 26 to 29 feet lift, to the summit-level extending 8.5 miles west of the lake. From that point the canal extends easterly, and, cutting across the divide with a maximum depth of 41.4 feet above the surface of the water, reaches the lake 17.27 miles from the Pacific terminus. The summit of the divide cut through by the canal, 151.4 feet above sea-level, is much the lowest depression across the American isthmus.

The lake navigation extends from the mouth of the river Lajas to Fort San Carlos at the head of the river San Juan: through that distance not less than 28 feet of water can be carried to within 2,400 feet of the west shore, and eight miles of Fort San Carlos. For the former distance, dredging and rock excavation are necessary; and in the latter, dredging in mud to an average depth of 3.5 feet, to extend deep water from shore to shore. Other parts of the lake are very deep.

The canal then follows the river San Juan for a distance of 64 miles from the lake to Ochoa, just below the confluence of the river San Carlos (*v.* map). Here a dam is proposed, 1,255 feet long and 52 feet high, which will back the water of the river the entire distance to the lake, maintaining the surface of the latter at the proposed level of 110 feet. The upper part of the river thus deepened and widened will be converted into an extension of the lake, at no place less than 1,000 feet wide, and, with the exception of the first 28 miles from the lake, the depth gradually increases from 28 to 130 feet. Within those 28 miles, dredging and rock excavation to an average depth of 4 feet will be needed for a distance of 24 miles. The dam is located between rock abutments, and is proposed to be built of concrete resting on rock foundations 20 feet below the present water-level.

Just above the dam, a break between the hills confining the river on the north, affords a desirable basin at the entrance of the canal, which here leaves the river. After running a distance of .62 miles through the basin, it cuts across a broken country for a distance of 1.82 miles, and enters the valley of the creek San Francisco. This creek runs nearly parallel to the San Juan, from which it is separated by a range of hills, to a point about 9 miles from the dam, then, receiving a tributary from the north-east, turns abruptly to the south and empties into the San Juan. Its valley forms an irregular, flattened Y, with its foot resting on the San Juan, one arm extending westerly to within a short distance of the dam at Ochoa, the other easterly in the direction of Greytown. Across the stem of this Y will be built an embankment 6,500 feet long on the crest, with a maximum depth of 51 feet. This embankment will retain the waters of the San Francisco, forming an artificial lake of 30 to 50 feet depth, at the level of the river above the dam, or an extension of the summit-level. The outlines of this lake and the increase in width of the San Juan, after its waters are dammed up at Ochoa, are shown in our map according to information kindly furnished by Mr. Menocal. The extent of country which will be inundated by the San Carlos cannot be defined, as the valley has not been surveyed. As its character, however, is similar to that of the San Juan, the strip of